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CONCERNING THE TONUS OF THE CARDIAC CENTER
OF THE VAGUS NERVE IN X-IRRADIATED DOGS

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-USSR-

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FOREWORD

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CONCERNING THE TONUS OF THE
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[Following is the translation of an article entitled "O Tonuse Serdechnogo Tsentra Bluzhdayushchego Nerva u Sobak, Obluchennykh Rentgenovymi Luchami" (English version above) by V.V. Antipov in Patologicheskaya Fiziologiya i Eksperimental'naya Terapiya (Pathological Physiology and Experimental Therapy), Vol IV, No 4, Moscow 1960, page 75.]

In experiments on nine dogs weighing from 12-19 kilograms and exposed to X-radiation, the stimulation of the cardiac center of the vagus nerve was studied. The irradiation was done with two RUM-3 machines at a focal distance of 100 centimeters, anode resistance 180 kilovolts, and current strength of 15 milliamperes. Filters were: 0.5 mm copper, and 1 mm aluminum. The total strength of the two apparati was 9.52 r/min. The radiation dose was 600 and 1,000 r. The indices of the tonus of the cardiac center of the vagus nerve were the frequency and rhythm of cardiac contractions and the magnitude of pulse pressure. In order to induce tonus stimulation of the cardiac center of the vagus nerve, we used morphine, calcium chloride, and urethane which increase the tonus of the vagus nerve center. We also used atropine and double vagotomy, thus inducing blocking and the cessation of efferent vagus impulses. Morphine (20-30 mg) and atropine (2-4 mg) were administered subcutaneously; Calcium chloride (40-50 mg/kg) and urethane (500-1,000 mg/kg) -- intravenously.

In all animals before irradiation, morphine, urethane, and calcium chloride slowed the pulse down to 18-42 beats per minute. Also, as a result of administering these preparations, arrhythmia was either induced, or, if already present, was strengthened. The pulse pressure was somewhat raised, primarily as a result of the lowered

minimal pressure. After administration of atropine, there was a quickening of the pulse to 86-116 beats per minute, the arhythmia disappeared, and the pulse pressure decreased, primarily because the minimal pressure was heightened.

In irradiated dogs (in the first reaction period, the concealed period, and in the period of acute radiation sickness) after administration of morphine, urethane, and calcium chloride, the reaction was the same as in un-irradiated animals. The pulse rate slowed down to 18-52 beats per minute, the pulse pressure increased, primarily because of the decrease in the minimal pressure, and arhythmia either began or became more intense. Administration of atropine and a severing of the vagus nerves at the neck brought on a quickening in the pulse rate to 96-136 beats per minute, a lowering of the pulse pressure, primarily because of the increase in minimal pressure, and a disappearance of arhythmia. Thus, morphine, urethane, and calcium chloride stimulated an increase in the tonus of the cardiac center of the vagus, both in irradiated and in non-irradiated dogs.

An analysis of the resulting data shows that in dogs examined during different periods of acute radiation sickness (up to 30 days from the moment of irradiation), there was no change in the tonus stimulation of the cardiac center of the vagus. This relative stability of the tonus of the cardiac center of the vagus in dogs probably can be partly explained by the resistance of the nervous system to irradiation. It seems, also, that the humoral factors play a significant role in the mechanism which creates and maintains the tonus at a given level. For instance, the calcium ion concentration does not change substantially in the developmental process of radiation sickness.